NDAG TASKING 2006-03
Issued March 13, 2006

Task Title: Recommendation for Nuclear Data Evaluator Staffing and Throughput

Task Statement: The NDAG is requested to provide a recommendation on the staffing levels for nuclear data evaluators that the NCSP should support at the various sites/labs AND what should be the expected types and throughputs of deliverables that should result from this level of effort. The NCSP Manager requests this recommendation in advance of the March NCSP meeting to help in adjusting the available funding for FY07. Since this is a relatively short notice and short duration tasking, the NDAG can adjust their response accordingly.

Task Deliverable: A formal written report to the NCSP Manager.

Task Due: March 22, 2006

Response to NDAG TASKING 2006-03
March 22, 2006

Input to this response was received from 6 labs. Most members addressed this tasking as a request for two distinct recommendations, namely, (i) staffing level for nuclear data evaluators and (ii) throughput of deliverables for data evaluators. The following discussion addresses them separately. It should be noted that recommendations herein apply exclusively to nuclear data evaluators, that is, nuclear data experimentalists, nuclear data modeling code development, nuclear data processing, nuclear data library generation, and nuclear data benchmarking and validation are **not** included.

Staffing Level for Nuclear Data Evaluators

Two of the 5 responses provided only recommended funding for their labs; three[*] of the 5 responses recommended funding levels for each of the labs.

Because this tasking to the NDAG requested funding levels "that the NCSP should support," some of the responses first addressed what evaluation efforts or evaluations are "needed". Consensus opinion was that NCSP should support evaluation efforts for 2 distinct reasons. The priority reason should be that the review of a request from the nuclear criticality safety community for evaluated nuclear data indicates that a new data evaluation is required. This would be indicated either because the available evaluated nuclear data perform poorly (as demonstrated by poor agreement with integral data) or because evaluated nuclear data are not available. The secondary reason should be to exercise and maintain a national capability to perform such nuclear data evaluations. Though secondary in priority for justification of evaluation efforts, this secondary reason was judged the primary reason to support this portion of the NCSP funding.

What funding levels are needed or justified based on these 2 distinct reasons for support of nuclear data evaluations? One might expect that the "apparent" long list of priority data needs would determine the minimum evaluation resources necessary to supply the NCSP needs. This would be the case if it were necessary to meet these needs in the very near term (as in a 1-2 year campaign). This is not the case. Therefore, it is concluded that resources necessary to support maintenance of national evaluation capabilities are greater than resources necessary to supply the number of priority evaluations requested by the nuclear criticality safety community.

There was consensus among responses in support of "greater than minimum" funding to exercise and maintain national evaluation capability. There was less than consensus among responses (that is, variation of ±0.5 FTE) that the "minimum" funding to maintain

[*] Because the ORNL response provided by Mike Westfall with input from Mike Dunn was rather detailed and was written in a very fair manner, it seems worth including it in this document (see Attachment 1).

U.S. capabilities was: ORNL – 2.0 FTEs, LANL – 1.0 FTE, ANL – 0.5 FTE, and BNL – 0.5 FTE.[†]

Given that the U.S. evaluation capability in the resonance region is centered (though not bounded by) and largely supported by the methods and expertise at ORNL, a strong case can be made that the minimum support of evaluation at ORNL cannot be less than 2 FTEs. Given that the complimentary expertise (covering the energy range above the resonance region) is largely supplied by LANL suggests the same argument for support of evaluation activities at LANL at the 2 FTE level. At present other NNSA programs support the maintenance and product of LANL evaluation activities; nevertheless, support of evaluation below 1 FTE (as is currently the case) is insufficient to guarantee resources to address NCSP needs. Evaluation effort of 0.5 FTE at ANL and BNL (neither of which is currently supported specifically for evaluation) is judged the minimum support sufficient to provide synergy with the other evaluation activities.

To repeat, these funding levels are presented as the **minimum** support of evaluation activities that will maintain U.S. capabilities and address priority data needs for the U.S. nuclear criticality safety program.

Throughput of Deliverables for Data Evaluators

Responses to this request focused on the "expected" number of evaluations produced by 1 FTE support of data evaluation effort. That is, deliverables for evaluators should be **complete** evaluations submitted to the NNDC or ENDF, where complete is defined as including cross sections, angular distributions, etc., for all open reaction channels over the complete energy range evaluated, such as the resonance region or above the resonance region up to 20 MeV. Previously, or until such time as covariance methodologies are incorporated into the evaluation codes, complete evaluations did not require covariance data.[‡] Furthermore, it is realized that 1 FTE year probably equates to ~9-10 months of actual focused work, considering the necessary distractions of vacations, meeting attendance, and administrative work (documentation, progress reports, writing papers, proposals, etc.).

The time required to produce a complete evaluation is impossible to answer definitely. It depends not only on the skill and experience of the evaluator and the status and capabilities of his evaluation tools, but also on specific evaluation being performed. In general, the time required for the evaluation depends on the nuclide, the number of reaction channels, the amount of available experimental data, and the expectations of the evaluation. Again, in general, the greater the number of reaction channels, the amount of

[†] No case was made for support of evaluation work at LLNL. It may be noted that although LLNL has not provided significant ENDF evaluations since the early and prolific quality contributions of R. Howerton, LLNL utilized ~0.25 FTE support from the USNDP for evaluation to produce 2 full evaluations for ENDF/B-VII and numerous partial evaluations for ENDF/A in FY06.

[‡] We appear to be rapidly approaching a time when covariance data can and will be generated as an integral part of the evaluation of the cross section data.

available experimental data, and the expectations of the evaluation, the more difficult and tedious is the evaluation task. This results in a range of expected values for the time to produce an evaluation or the number of evaluations per 1 FTE year.[§] Consensus was that if effort was concentrated on the more complicated evaluations expected output for the year might be 1-2 evaluations; whereas if effort was concentrated on the less complicated evaluations expected output for the year might be 5-6 evaluations.[**] Therefore, it appears reasonable to say that, on average, the expected number of evaluations per evaluator per year would be 3-4.

Summary

Responses to the request for "staffing levels for nuclear data evaluation which should be supported by the NCSP" have focused on the minimum support which will maintain U.S. capabilities and will address priority needs of the nuclear criticality safety community. It is hoped that support for these efforts can be maintain above these minimum levels.

Responses to the request for "throughput of deliverables for data evaluators" have discussed the expected range and average values of number of complete evaluations produced by evaluation support of 1 FTE year.[††]

[§] As a "reality" check for the time/effort estimates reported herein, input was obtained from some of the principal U.S. and European data evaluators (such as, Phil Young, A. B. Smith, Aryan Koning, etc.).

[**] It was also noted that evaluations for a great number of "lesser" isotopes or isotopes for which little or no measured data are available can be done with much less time and effort (i.e., completing "tens" of evaluations per FTE year).

[††] Again, because the ORNL response produced a detailed summary of recent and projected deliverables for the ORNL NCSP evaluation effort (derived largely by the nice effort of Mike Westfall and Mike Dunn to extend the Data Needs Lists into the out-years), it seems worth including it in this document (see Attachment 2).

Attachment 1

From: Westfall, Robert Michael [westfallrm@ornl.gov]
Sent: Friday, March 17, 2006 1:14 PM
To: McKnight, Richard D.
Cc: Dunn, Michael E.; Parks, Cecil V.
Subject: FW: Urgent NDAG Task

Attachments: ORNL_Nuclear_Data_Evaluator_Effort_Mar17'06.doc

Dick,

Attached is a table which summarizes the current ORNL activity in cross section evaluation, including the development of covariance files.

Included are the ORNL deliverables from work-in-progress and projected work in the out years from the Nuclear Data Schedule.

Below, in the text of this e-mail, is our summary of NCSP supported nuclear data evaluation activity at all of the DOE Labs in the context of the overall DOE data evaluation activity.

This is offered in the spirit of our participation in an open discussion of DOE evaluation activity and funding support areas. In this regard, we realize that each of the other Labs may have corrections to our information and the associated derived estimates.

Best Regards,
Mike Westfall

> Mike,
>
> I have put together a table (see attached file) that summarizes the ORNL Nuclear Data evaluator effort for the NCSP. As for the evaluation products, I have used our latest version of the Appendix D table in the 5-Yr plan to project the evaluation products for FY2008—FY2010. I am glad that you, Luiz, and I put forth the effort to fill in the blanks back in January.
>
> Also, you will note that I provided information about additional evaluation products that are made possible because of the NCSP infrastructure report that we receive. The EM ^{55}Mn and RW fission product work would not be possible without the base NCSP infrastructure funding. **This is a key point that should be included in the discussions pertaining to the NCSP evaluation support.** The other labs such as LANL and BNL receive data funding from other sources that can be used to leverage against the NCSP. Although leveraging support with the NCSP is also part of our strategy at ORNL, we are in somewhat of an opposite position as LANL and BNL with regard to the NCSP. In other words, we depend upon the NCSP for the bulk (i.e., ~80-90%) of our support. Our NCSP support is supplemented from other sources such as RW and EM. So, in the following subsequent discussion, I have tried to provide the “bigger” picture with regard to evaluation support.

BNL

My understanding is that BNL receives the bulk of their funding from the Office of Science U.S. Nuclear Data Program (USNDP) program. According to the FY2006 USNDP Plan, BNL was scheduled to receive support for 9.15 R&D FTEs and 2.3 admin FTEs. Of the 9.15 FTE USNDP support, the BNL breakdown is as follows:

USNDP Task	FTE
NNDC Facility Operations	1.45
Coordination	0.6
Nuclear Physics Databases	1.35
Information Dissemination	1.35
Nuclear Structure Physics	3.30
Nuclear Reaction Physics	1.10
Total	**9.15**

Of the total USNDP R&D support, I would project that 4.4 FTEs could be categorized as evaluation work (i.e., Nuclear Structure Physics and Nuclear Reaction Physics). With regard to evaluation support from the NCSP in FY2006, BNL will receive $70k for covariance data development ($30k) and gamma-ray production for fission product nuclei ($45k). So, this is less than one third of evaluator FTE support (i.e., probably around 0.2 FTE) in FY2006 from the NCSP. I did not check their FY2007 and outyear task proposals for this exercise.

LANL

In FY2006, LANL was projected to receive 1.7 R&D FTE support for the USNDP with an additional 14.4 R&D FTE support from ASCI, AFCI, NCSP, and LANL LDRD funding. According to the NCSP 5-Yr plan, LANL will receive $280k to support evaluation efforts. This NCSP support is most likely less than 1 FTE; so, I would guess around ~0.8 FTE. So, the total **non-NCSP** evaluation support is somewhere around 15.3 FTEs. [Note, per LANL, non-NCSP evaluation support is ~4-5 FTEs and includes ~0.1 FTE USNDP evaluation support. (RDM)]

ANL

In the last few years, ANL has not had a large cross-section evaluation effort. In FY2006, ANL was scheduled to receive $220k nuclear data support (less than 1 FTE). My understanding is that most of the nuclear data work has focused on evaluation testing. However, some support is devoted to supporting evaluation methodology development which I believe is largely performed by retirees such as Don Smith and Dick Hwang. I do not know the breakdown on the evaluation support.

LLNL

In FY2006, LLNL does not have support for cross-section evaluation work. I did not check the FY2007 task proposals. [Note, per LLNL, USNDP evaluation support is 0.25 FTE for FY06. (RDM)]

If you use the above information to project beyond FY2006 (i.e., assume the other labs continue to receive comparable evaluation support from their other sources), I would project the following evaluation support for ORNL, BNL and LANL.

Estimated Evaluation Support

Lab	NCSP (FTE)	Non-NCSP (FTE)
ORNL	3.8	1.2
BNL	~0.2	4.4 [0.25 per BNL]
LANL	~0.8	15.3 [4-5 per LANL]
ANL	~0.5	??

Mike

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<<NDAG TASKING 2006-01.doc>> <<NDAG TASKING 2006-02.doc>> <<NDAG TASKING 2006-03.doc>>

Attachment 2.

ORNL NCSP Evaluation Effort

Evaluators	Full Time Luiz Leal (1 FTE) Herve Derrien (1 FTE) Royce Sayer (1 FTE) Part Time Goran Arbanas (0.5 FTE) Dorothea Wiarda (0.5 FTE)
Year	**Deliverables: resonance evaluations with covariance data**
FY 2006	URR: ^{238}U ^{19}F inelastic evaluation Resonance parameter covariance data: ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{233}U, ^{235}U, ^{238}U, ^{35}Cl, ^{37}Cl, ^{19}F Evaluations delivered to NNDC: ^{232}Th, ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{233}U, ^{35}Cl, ^{37}Cl
FY 2007	RRR: ^{55}Mn, ^{39}K, ^{40}K, ^{41}K Resonance parameter covariance evaluations ^{55}Mn, ^{39}K, ^{40}K, ^{41}K, ^{239}Pu, ^{241}Pu _(E) and $\bar{\nu}$ covariance data: ^{233}U, ^{235}U, ^{239}Pu, ^{241}Pu Evaluations delivered to NNDC: ^{39}K, ^{40}K, ^{41}K, ^{19}F, ^{233}U, ^{235}U, ^{238}U, ^{239}Pu, ^{241}Pu
FY 2008	RRR with covariance data: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu URR with covariance data: ^{55}Mn Evaluations delivered to NNDC: ^{55}Mn
FY 2009	RRR with covariance data: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V URR with covariance data: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu Evaluations delivered to NNDC: ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu
FY 2010	RRR with covariance data: Li, ^{138}Ce ^{140}Ce, ^{142}Ce URR with covariance data: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V Evaluations delivered to NNDC: ^{237}Np, Ti, ^{240}Pu, Be, Ca, ^{51}V
Additional products that will be made possible through NCSP infrastructure support[a]	
IAEA Th-U CRP (complete evaluations in FY2007):[b] ^{232}U, ^{236}U, ^{231}Pa, and ^{233}Pa DOE/RW fission product evaluations (FY 2007—FY2009): ^{103}Rh, ^{133}Cs, ^{155}Gd, ^{143}Nd, ^{149}Sm, ^{151}Sm, ^{153}Eu, and ^{155}Eu	

[a]At ORNL, the NCSP provides ~90% evaluator staffing support, and this infrastructure support facilitates additional evaluation work that benefits the NCSP and other DOE programs such as EM and RW. EM and RW funding supports the incremental costs of work in their specific areas. The EM work (waste disposition) and the RW work (burnup credit) are criticality safety applications of NCSP technologies.

[b]With the exception of travel expenses, the NCSP has supported Luiz Leal's involvement in the international IAEA Th-U Cooperative Research Project (CRP). The Th-U IAEA CRP concluded in FY2006. As a direct benefit to the NCSP, the CRP has developed a new ^{232}Th evaluation that will be included in ENDF/B-VII in FY 2006. As an added benefit from the CRP involvement, additional evaluations for ^{232}U, ^{236}U, ^{231}Pa, and ^{233}Pa will be provided to ENDF in FY2007. A significant portion of this effort (non-neutron resonance portions) is performed by the other participants on an international cooperative basis without cost to the NCSP.